Earth Science

Combined HSRL and Optical Autocovarience Wind Lidar Demonstration (HOAWL)

Completed Technology Project (2012 - 2015)

Project Introduction

Global observations of atmospheric aerosol scattering and extinction profiles are needed to directly support several Decadal survey missions (e.g. ACE, GACM). Precision passive measurements of atmospheric trace gasses and ocean color require calibrated aerosol profile measurements to perform aerosol scattering calibration corrections. While lidar is an ideal instrument to make range resolved aerosol scattering measurements, simple single channel backscatter lidars (e.g. CALIPSO) cannot directly provide the desired calibrated aerosol scattering profiles because the backscatter signal depends on backscatter cross section from each range and the optical depth to the scattering volume. Fortunately, molecular backscatter is Doppler broadened, while aerosol backscatter remains narrow. The High Spectral Resolution Lidar (HSRL) technique spectrally separates molecules and aerosols lidar returns. With known air density, HSRL separately measures extinction and scattering at every range. The best current HSRL method uses an iodine absorption filter to eliminate aerosol scatter from the molecular signal, but is limited to iodine absorption feature wavelengths. The most research-valuable wavelength-dependent aerosol property retrievals require three aerosol backscatter wavelength and two extinction wavelength profiles spanning the UV to NIR. Ball has developed the theory for extraction of HSRL data products from a multi-wavelength Optical Autocovariance Wind Lidar (OAWL) instrument simultaneously with Doppler wind lidar measurements. Ground-based Doppler wind lidar measurements from OAWL have successful been demonstrated under a NASA IIP award which will also perform an airborne demonstration. We propose to leverage the OAWL IIP hardware by augmenting the hardware, and developing the control, acquisition, and processing software to simultaneously demonstrate a multi-wavelength HOAWL implementing an integrated 2alpha+2beta+2delta system, exiting at TRL 4 with a ground-validated HOAWL demonstration. An instrument capable of both wind and HSRL measurements would provide an opportunity to combine the lidar portion of the ACE mission with the 3D-Winds mission, resulting in major cost savings to NASA.

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Organizational Responsibility

Responsible Mission Directorate:

Science Mission Directorate (SMD)

Lead Center / Facility:

NASA Headquarters (HQ)

Responsible Program:

Earth Science

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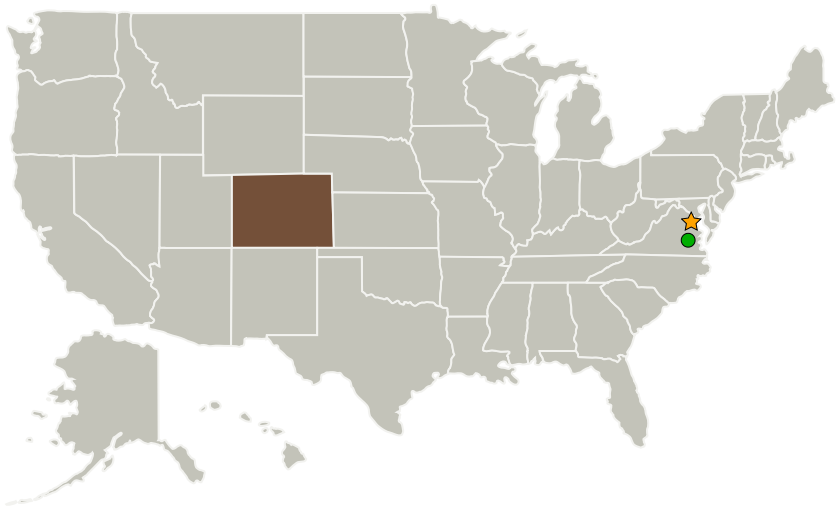
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★NASA Headquarters(HQ)	Lead Organization	NASA Center	Washington, District of Columbia
Ball Aerospace & Technologies Corporation	Supporting Organization	Industry	Boulder, Colorado
●Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations
Colorado

Project Management

Program Director:

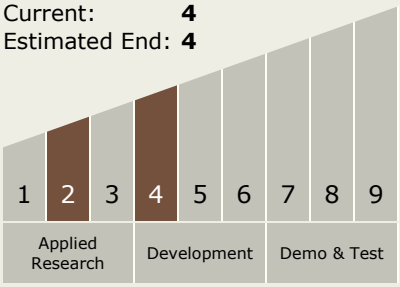
George J Komar

Principal Investigator:

Thomas P Delker

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.5 Lasers

Target Destination

Earth